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Evaluation of complex congenital heart disease and associated complications in newborns, infants and small children using multi-detector CT (MDCT) – An 11-years-experience at 5 centers

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Introduction: MDCT with multiplanar and 3D-reconstructions has become an important first-line imaging tool in diagnosis of complex congenital heart (CHD) and airway diseases in children. Aim was to assess the diagnostic value of MDCT in newborns and infants at 5 centers of 3 countries.
Materials and Methods: Between 2000 and 2011, 281 patients (mean age: 7 ± 7 months, range: 6 hr to 2 y) were examed using varying scanners (4 up to 256 slices, resolution isotrope 0.4-1.25 mm; scan-time 2-20 s, 80-120 kVp, 60-80 mA) under ventilation or free breathing. Diagnoses: in-stent stenosis (n=72), pulmonary stenosis (48) and atresia (32), arterial rings and slings (32), aortic arch anomalies (21), bronchoscopy revealed stenosis (24), abnormal pulmonary venous return (17) and others (35). The image quality was rated using a 5-point score. Image findings were correlated to ECHO, conventional angiography, bronchoscopy, and intraoperativ findings. The effects of dose on image quality were also evaluated, retrospectively.
Results: MDCT data were almost free of cardiac and respiratory motion. Images were scored in >95% of all cases as excellent or good, showing a significant improving with increasing number of detectors. Radiation exposure was mostly less than 2 mSv (range 0.3 to 3.2). High radiation exposure settings did not improve image quality. Morphology and topography could be assessed exactly and the final diagnosis was allowed. Even smallest vessels (diameter < 1 mm) could be identified and excel¬lently visualized. 83% (232/281) of all patients had benefited from MDCT: Catheter was neither necessary to perform treatment planning nor to exclude an anomaly, or radiation doses and sedation time due to interventional procedures could be reduced markedly.
Conclusions: A 3D submillimeter evaluation of CHD can be achieved routinely in a matter of seconds with little motion artefacts, without general anesthesia and with low radiation exposure. The use of MDCT may result in a net decrease in overall radiation decreasing the number of diagnostic catherizations. MDCT can now be regarded as the modality of choice as a minimally invasive, robust, and accurate technique. This advance should have the greatest impact in the smallest, youngest, and most critically ill children.